CLAIMS

What Is Claimed Is:

1. An adsorbent filter material useful for removing a solute from a fluid, comprising:

a liquid permeable fibrous support material comprising fibers having hydroxyl groups, hydrolyzable alkoxyl groups, amino groups, or sulfhydryl groups;

an adsorbent porous inorganic gel coating on the fibrous support material, wherein the inorganic gel coating has been molecularly imprinted for the solute using template molecules present during formation of the inorganic gel coating but selectively removed thereafter from the filter material, effective that the inorganic gel coating is more effective in removing the solute from the fluid relative to an inorganic gel coating that has not been molecularly imprinted.

2. The adsorbent filter material according to claim 1, wherein the inorganic gel coating is at least about 50 percent more effective in removing the solute from the fluid relative to the inorganic gel coating that has not been molecularly imprinted.

3. The adsorbent filter material according to claim 1, wherein the fibrous support material is selected from the group consisting of cellulose, methylcellulose, cellulose acetate fiber, chitosan, polylactic acid, nylon, polyamine, polyamide, polysolfone, polydextrine, and combinations thereof.

4. The adsorbent filter material according to claim 1, wherein the fibrous support material comprises cellulose having a lignin content of less than 1.0 percent.

5. The adsorbent filter material according to claim 1, wherein the inorganic gel coating comprises a silica gel.

6. The adsorbent filter material according to claim 1, wherein the inorganic gel coating comprises a silica gel coating obtained by reaction of silicon alkoxide with surfaces of the fibrous material, wherein the fibrous support material surfaces have been pretreated with a metal hydroxide.

7. The adsorbent filter material according to claim 1, wherein the inorganic gel coating comprises a gel structure comprising a metal or metalloid comprising metal selected from the group consisting of silicon, aluminum, titanium, zirconium, and vanadium.

8. The adsorbent filter material according to claim 1, wherein the molecular imprinting comprises alterations to the inorganic gel coating imparted by the presence of caffeine as template molecules during formation of the inorganic gel coating, and subsequent removal of the template molecules while leaving the inorganic gel coating anchored in place to the fibrous support material.

9. The adsorbent filter material according to claim 1, wherein the filter material is a unitary self-supporting body.

10. A method of making an adsorbent filter material useful for removing a solute from a fluid, comprising:

contacting a fibrous material comprising fibers having hydroxyl groups or hydrolyzable alkoxyl groups with a fluid containing a base that dissociates in water to generate hydroxyl ions to provide a fibrous support material comprising surface-treated fibers;

combining the fibrous support material with a sol gel precursor, a gel formation solvent, and template molecules, with mixing;

forming an inorganic gel coating on the surface-treated fibers, including molecularly imprinting the solute on the inorganic gel coating with the template molecules present during formation of the inorganic gel coating;

selectively removing the template molecules from the gel coating by washing the gel coating with a solvent that selectively removes the template molecules to provide a composite MIP filter material, wherein the inorganic gel coating is more effective in removing the solute from a fluid relative to an inorganic gel coating that has not been molecularly imprinted.

11. The method of claim 10, comprising selecting the fibrous support material from the group consisting of cellulose, methylcellulose, cellulose acetate fiber, chitosan, alginate, polylactic acid, nylon, polyamine, polyamide, polysolfone, polydextrine, and combinations thereof.

12. The adsorbent filter material according to claim 1, comprising selecting the inorganic gel coating comprises a gel structure comprising a metal or metalloid comprising metal selected from the group consisting of silicon, aluminum, titanium, zirconium, and vanadium.

13. A method of making an adsorbent filter useful for removing a solute from a fluid, comprising:

contacting cellulose fibers with a fluid containing a base that dissociates in water to generate hydroxyl ions to provide a fibrous support material comprising surface-treated cellulose fibers;

impregnating the surface-treated cellulose fibers with an organic solution;

combining the impregnated cellulose fibers with a sol gel precursor and template-molecules, with mixing;

forming an inorganic gel coating on the surface-treated cellulose, including molecularly imprinting the solute on the inorganic gel coating with the template molecules present during formation of the inorganic gel coating;

selectively removing the template molecules from the gel coating by washing the inorganic gel coating with a solvent for the template molecules to provide a composite MIP filter material, wherein the inorganic gel coating is more effective in removing the solute from a fluid relative to an inorganic gel coating that has not been molecularly imprinted.

14. The method according to claim 13, wherein the inorganic gel coating forming comprises forming a sol gel with a gel precursor selected from a metal or metalloid in which the metal component is selected from the group consisting of silicon, aluminum, titanium, zirconium, and vanadium.

15. The method according to claim 13, wherein the inorganic gel coating forming comprises forming a sol gel with a gel precursor comprising a silicon alkoxide.

16. The method according to claim 13, wherein the cellulose fiber is selected as having a lignin content of less than 1 percent.

17. The method according to claim 13, wherein the template molecule is selected from the group consisting of caffeine, cholesterol, lipid, sugar, and organocidal compounds.

18. The method according to claim 13, further comprising compressing the MIP composite material into a self-supporting unitary shape.

19. A method for filtering a solute from a fluid, comprising:

providing an adsorbent filter material, wherein the filter material comprises a liquid permeable fibrous support material comprising fibers having hydroxyl groups or hydrolyzable alkoxyl groups, and an adsorbent porous inorganic gel coating on the fibrous support material, wherein the inorganic gel coating has been molecularly imprinted for the solute using template molecules present during formation of the inorganic gel coating but selectively removed thereafter from the filter material;and

passing a fluid containing a solute through the adsorbent filter effective to retain at least a portion of the solute in the filter material, wherein the inorganic gel coating is more effective in removing the solute from the fluid relative to an inorganic gel coating that has not been molecularly imprinted.

20. The method according to claim 19, wherein the inorganic gel coating comprises silica, and the fibrous support material comprises cellulose.

21. The method according to claim 19, wherein the fluid comprises a caffeinated fluid and the solute comprises caffeine.

22. The method according to claim 19, wherein the solute comprises caffeine, and the fluid comprises a caffeinated fluid selected from coffee, tea, cola or carbonated soda drink.

23. The method according to claim 19, wherein the fluid comprises a lipid-containing material in a flowable state and the solute comprises cholesterol.

24. The method according to claim 19, wherein the solute comprises cholesterol, and the fluid comprises a lipid-containing material selected from egg yolk, butter fat, beef tallow, and fish oil.

25. The method according to claim 19, wherein the fluid comprises water and the solute comprises an organic compound selected from a pesticide and a herbicide.

26. The method according to claim 19, wherein the fluid comprises a natural food matrix in a flowable state and the solute comprises a sugar.

27. The method according to claim 19, wherein the fluid comprises a food lipid or an oxidized food lipid in a flowable state, and the solute is selected from an aldehyde and a ketone.